To: **Mike Sampson** **April 6, 1998**
NASA Goddard Space Flight Center (GSFC)

From: **Jay Brusse (301-286-2019)**
Unisys Corporation at NASA GSFC

Subject: **Trip Report for Space Parts Working Group Conference in Torrance, CA**

Summary

The US Air Force Space and Missile Systems Center (Dave Davis) and The Aerospace Corporation (Mel Cohen and Larry Harzstark) hosted the *Space Parts Working Group (SPWG)* conference on March 24 and 25, 1998 in Torrance, CA. The SPWG is an annual forum for government, international space partners, contractors (hardware builders, testers, and experimenters), and manufacturers to share their experiences with respect to manufacturing, selection and application practices for EEE parts for a variety of space flight applications. Approximately 300 people attended the conference. Common topics included:

- Approaches to parts control for space (commercial space, military, NASA)
- Approaches to the use of Commercial Off The Shelf (COTS) items in space flight programs
- Impacts of and approaches to the Department of Defense Acquisition Reform initiative (initiated by former Defense Secretary William Perry ~1994)
- Developments in military and industry parts control policies and procurement specifications
- Approaches to using Plastic Encapsulated Modules (PEMs) in space
- Topics in radiation effects (testing approaches, test results, product developments)
- Developments in the marketplace for space grade components
- Developments in manufacturer products for space flight

The presentation package (meeting minutes) will be distributed to all attendees within the next two to three months. Jay Brusse from Unisys at NASA Goddard attended the conference and presented on behalf of the Components Technology Branch (Code 562) at GSFC. An overview of the highlights from this conference is provided below. Please contact Jay Brusse at (301) 286-2019 if you have any questions.

Sincerely,

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Component Engineer
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Trip Report for
Space Parts Working Group Conference
in Torrance, CA March 1998

NASA Parts Program Presentation from Goddard

A copy of the presentation given on behalf of NASA GSFC is available from Jay Brusse upon request. The presentation focused on the parts engineering/selection tools currently available from GSFC via the World Wide Web. These tools include such homepages as:

NASA Parts Selection List (NPSL)	http://misspiggy.gsfc.nasa.gov/npsl
EEE Parts Information Management System (EPIMS)	http://epims.gsfc.nasa.gov
Parts Analysis Web (PAWS)	http://epims.gsfc.nasa.gov
EEE Links Newsletter	http://arioch.gsfc.nasa.gov/ 312/Linkspg.htm

Additional topics included discussion of the deliverables produced by the Supplier Assessment Programs (PSAP – Passives, ASAP – Actives) such as the on-line "Core Suppliers Listings", information bulletins via e-mail and technology inputs into the NPSL. PSAP and ASAP personnel also participate as the voice of NASA in DoD and industry meetings for EEE parts.

Commercial Off The Shelf (COTS)

If there was one point that became very clear from all of the various presentations given on COTS, it would be: *there is no universal definition for COTS*. Every organization has their own interpretation of what constitutes a Commercial Off The Shelf item. Some define COTS as the manufacturer's high volume product. Some think of COTS as ANY part that can be procured directly from the vendor catalog. Others consider COTS to be defined in terms of their operating temperature range. And still others consider COTS to be any item (military grade, space grade, industrial grade or otherwise) which is readily available and can be procured without special instructions or requirements. The IRIDIUM program from Motorola defines COTS as "Industrial Grade" components purchased straight from a vendor's catalog.

Regardless of the definition used for COTS, the recurring theme from all of the presenters is that *COTS can be used successfully in space flight applications*. However, problem-free usage is contingent upon applying the appropriate engineering resources in the form of part and vendor selection, design and application considerations, parts engineering and procurement engineering. Large programs such as IRIDIUM (with well over 100 satellites in the constellation) are capable of amortizing (over a multi-billion dollar program) the Non-Recurring Engineering (NRE) costs associated with COTS selection such as source inspection and product qualification. IRIDIUM can accept additional risk due to the availability of redundant satellites. In addition, the benefits of the economies of scale with high volume procurements give the IRIDIUM procuring activity access to and influence over vendors which are critical factors to making successful product and source selections. In small programs such as those typically managed by NASA, the additional engineering costs and associated risks with using COTS may be far greater than the costs of procuring high reliability, space grade components which have a history of reliable performance.

Manufacturer Comments on Use of COTS in Space

The manufacturers who were represented (National Semiconductor, Harris, International Rectifier, Microsemi, Analog Devices, TI, to name a few) had common recommendations regarding use of COTS for space flight applications:

- Use robust designs capable of using the manufacturer's "standard" high volume product (NOTE: The manufacturer's "standard" product typically has a broader distribution of parametric variables than the equivalent military specification product including some parameters which may not be specified in the catalogs or military specifications. Ex.: Inductance of resistors is typically more widely distributed in "standard" product than in military product)
- Do NOT ask the manufacturer for special processing that is outside of their normal process capabilities and flows
- Minimize handling of parts to reduce risk of damage (ESD, electrical test overstress, physical damage)
- Do NOT use COTS beyond the manufacturer's rated conditions
- Attempts to upscreen COTS will null and void all warranties and most suppliers will not provide any technical assistance in the event of failures of parts which have received third party testing/handling (International Rectifier disagreed with this point and indicated a willingness to work with their customers regardless of the cause of the problem)
- Commercial products are subject to manufacturing process and material changes WITHOUT NOTICE
- Some manufacturers may produce their commercial products in several locations each of which may use different materials and processes. This makes knowing the manufacturer and the products they supply much more difficult.
- Space flight users should try to forecast their product needs (4 years in advance) to the suppliers to help reduce obsolescence risks
- Where possible the space flight community should try to combine their product needs in order to appear as one large customer rather than several small ones. This would give the space community greater influence over market trends.

In summary, successful use of a vendor's commercial product in space flight applications requires the user to have knowledge of where and how the manufacturer builds its products and when process/material changes occur. Changes do occur and engineering resources will have to be applied in order to assess the manufacturer's "current" product. Therefore, requalification of a given commercial product may be necessary due to ongoing changes in processing and materials.

Military Market and Specification Developments

The following is a brief summary of the recent or in-process changes in the military marketplace and military specification:

Passives:

Specification Issues:

- MIL-PRF-49470 for Ceramic Switch Mode Power Supply (SMPS) capacitors has been released and several sources are in the process of qualifying. Most will try to qualify only the smallest sizes, but AVX Olean plans to qualify all six case sizes. This specification will ultimately replace DSCC-DWG-87106. SMPS capacitors made in accordance with 87106 have been plagued by numerous problems including thermal cracking, solder fatigue, flux entrapment, and reverse bias failures. The first qualified sources to 49470 are expected by the end of FY98.
- MIL-C-123 has been "performance" converted as of Jan. 1998. The allowable capacitance range has been increased for the CKS06 to allow for up to 1 uF.
- Many passive specifications have been modified to include a "T" level for space grade requirements and a "C" level for quasi-commercial offerings from a certified QPL line.
- Optional Surge Current testing was added to MIL-PRF-55365 (tantalum chip capacitors)
- MIL-PRF-55681 (ceramic chip caps) will soon have slash sheets offering the smaller chip sizes including 0402, 0504 and 0603. Drafts of these slash sheets are expected in June 1998.

Manufacturer Issues

- Vishay Sprague (Sanford, ME) is moving their assembly and test operation for MIL-PRF-39003 (leaded, solid tantalum capacitors) to Juarez, Mexico (initial audit occurred March 1998). Production of the anode slug will remain in the U.S. for the time being.
- Vishay Sprague is discontinuing production of CWR06 conformal-coated tantalum chip caps and promoting the form, fit and function replacement CWR09 molded chip instead.
- Dale (Bradford, PA) moved their MIL-PRF-55182 (film resistor) line to Israel in 1997

Actives:

Specification Issues

- ***A meeting will be held at DSCC April 1-2 to discuss adding a new Class level for "Satellite Constellations" (i.e., high volume space level) in each of the key active parts specifications MIL-PRF-38535, MIL-PRF-38534 and MIL-PRF-19500. The designation for this classification is being called Class "T". A draft of the proposed changes is available.***
- MIL-PRF-38535 (Microcircuits): The latest revision (12/97) has the following changes
  - Removed requirement for qualification to a minimum neutron fluence level for RHA rated parts
  - Neutron and SEE testing will be performed only if specified on the purchase order
  - HAST for PEMs increased from 50 hour test to 100 hour test
  - SEE testing moved to Appendix A
- QML-38535 (Microcircuits): There are currently 30 suppliers (10 are "V" level. 7 have Radiation Hardness Assurance [RHA] qualification). Four new sources are seeking QML certification.

Actives:

Specification Issues (Continued)

- MIL-PRF-38534 (Hybrids): Proposed updates for the next revision
  - Add appendix for RHA requirements
  - Rewrite the element evaluation requirements (considering removing element evaluation requirement for JAN discretes which should be acceptable based on MIL-PRF-19500 processing/testing)
  - Change the acceleration test levels from 6000 g to 3000 g and from 10,000 g to 5,000 g respectively
  - Delete Appendix D for new technology qualification and move the key requirements into Appendix C
  - Comment was made that no one has been buying hybrids to the newer Class Levels added to the specification in 1995 (Class G- hi rel, Class D – consistent product, Class E – G, H or K with exceptions)
- QML-38534 (Hybrids): There are currently 44 suppliers (7 are Class "K"). Eleven new sources are seeking qualification. Three sources have opted for the Technical Review Board (TRB) option offered by this specification (Analog Devices, Remec and Lockheed Martin)
- MIL-PRF-19500: Recent changes
  - New products have been added to 19500 including Rad hard MOSFETs, SMT transistors and rectifiers, power packaging products (TO-25x types), high voltage FETs
  - Amendment 1 adds a DMS section, modifications to JANC for Class H and K hybrid use
  - Contains "Test Optimization" provisions, but no TRB

Other Highlights:

- Andrew Moor of the Applied Physics Laboratory gave a valuable presentation outlining the approach taken to qualify Plastic Encapsulated Modules (PEMs) for space flight.
- Stephane Ponomarenko of the French Space Agency gave a presentation entitled "French Initiative on Commercial 3E Parts Policy for Space Applications". The primary message was "although CNES is well engaged with French industry in that field, at the project level the use is limited and implementation is selective based mainly on performance criteria".
- Wayne Dailey of Motorola gave a presentation on the Parts Program for the (commercial space) Iridium program.
- Alain Mouton of Matra Marconi discussed the status of an ISO standard for Parts Control Requirements (ISO-14621-2). The basic concept of this standard follows the ideas put forth in AIAA-R-100 Parts Management specification. This standard is expected to be approved by the end of FY98. The draft is available from Jay Brusse.
- Leon Hamiter of CTI gave a summary of the information shared at the recent Commercialization of Space Working Group meeting in Huntington Beach, CA in February 1998. Many of the ideas shared at this conference mirror those discussed at the SPWG conference.
- Numerous presentations were given about Radiation effects: including presentations by Chuck Barnes (JPL), Lew Cohn (DSWA), Capt. Dan King (Philips Labs), Al Kuehl (US Army), Philip Layton (SEI) and Don Mayer (The Aerospace Corp.)
- Sandy Kraft from GIDEP gave a presentation on the information available through GIDEP plus some new initiatives in data sharing by OEMs (Lockheed sharing their database on fasteners). Off the record she stated one valuable portion of GIDEP is the on-line calibration guidelines shared by manufacturers of test equipment. This could be very useful for metrology, calibration and repair organizations.